REMARKS

Claims 1-21, 35-58, and 64-71 will be pending upon entry of the present amendment. Claims 16, 41, 43, 64, and 65 are amended, claims 22-34 and 59-63 are cancelled, and new claims 69-71 are herewith submitted.

Applicants thank the Examiner for indicating the allowability of claims 50-53, 57, and 58.

Claims 22-34 and 59-63 have been cancelled as being substantially repetitive of other claims currently in the application. New dependent claims 69 and 70, depended from claim 1 and 16, respectively, have been added as substitutes.

The Examiner has rejected claims 1-5, 7-13, 15-29, 21-26, 28-32, 34-38, 40-45, 47-49, 54-56, 59-61, 63-66, and 68 under 35 U.S.C. § 103(a) as being unpatentable over Moraski et al. (US 4,645,904) or Jurcik et al. (US 6,076,359) in view of Tanaka et al. (US 5,005,370). The Examiner has rejected claims 6, 14, 20, 27, 33, 39, 46, 62, and 67 under 35 U.S.C. § 103(a) as being unpatentable over Moraski et al. or Jurcik et al. in view of Tanaka et al., and further in view of Barbulesco (US 2,859,759) or Nielsen (US 4,032,070).

Claim 1 recites "a capacity control valve having ...a diaphragm within the valve body dividing the thermal expansion chamber from the liquefied gas inlet chamber, the diaphragm being movable in response to a pressure imbalance in the thermal expansion chamber and the liquefied gas inlet chamber." As the Examiner has observed, neither Moraski nor Tanaka teach the capacity control as recited in claim 1. The Examiner has attempted to show Tanaka as teaching a valve having an equivalent function. However, this is not the case. The valve taught by Tanaka is fundamentally different from the valve recited in claim 1.

Applicants call the Examiner's attention to Figure 3 of Tanaka, which depicts Tanaka's inventive valve. The diaphragm of Tanaka's valve is indicated at 58. A temperature sensor 64 provides a pressure input through a capillary tube 62 to be in fluid communication with the pressure applying chamber 61. On the other side of the diaphragm 58, the auxiliary pressure applying chamber 65 is in fluid communication with the evaporator, via the capillary tube 76. Thus, Tanaka teaches a diaphragm which is movable in response to a pressure imbalance between the temperature sensor 64 and the evaporator, and fails to teach a diaphragm movable in response to a pressure imbalance between the thermal expansion chamber and the liquefied gas

inlet chamber. The evaporator of Tanaka is downstream from Tanaka's valve, and so, is certainly not analogous to the liquefied gas inlet chamber of claim 1.

Claim 1 further recites "the valve being moved toward the closed and open configurations in response to movements of the diaphragm resulting from differential pressure in the thermal expansion chamber and the liquefied gas inlet chamber, with . . . the pressure in the liquefied gas inlet chamber being dependent on the pressure of the liquefied gas supplied by the source of liquefied gas." Tanaka fails to teach or suggest this limitation as well, teaching rather, a valve configured to move toward opened and closed in response to movements of the diaphragm resulting from differences in pressure between the thermal tube 64 and the evaporator. Furthermore, both Jurcik and Moraski teach away from a combination with a valve of the type taught by Tanaka.

For example, a combination of Tanaka's valve with the control system taught by Jurcik might reasonably be arranged as follows: an outlet from the gas 312 of Jurcik coupled to the inlet of Tanaka's valve at P_H. The outlet of Tanaka's valve coupled to the superheating means 306 of Jurcik. Tanaka's thermal tube 64 positioned as the temperature sensor 318 of Jurcik, with Tanaka's evaporator inlet 76 coupled to the superheating means 306. Such a combination is superficially consistent with the operation of both devices.

However, such an arrangement is potentially disastrous. In the event that the user demands vaporized gas at a rate that exceeds the capacity of the superheating means, a chain of events follows. As the output flow from the superheating means increases, the temperature will begin to drop. As the temperature drops, the fluid within the thermal tube will begin to contract, reducing the pressure within the pressure chamber 61, which will begin to close the valve, reducing the output flow of the valve. As the output flow is reduced, the pressure of the coolant in the superheating means will begin to drop, reducing the pressure in the chamber 65 on the opposite side of the diaphragm, resulting in a balanced pressure at the diaphragm, which will tend to reopen the valve.

At this point, the demand for vaporized gas now exceeds the volume of gas passing through the valve, which will depress the pressure of gas within the superheating means, maintaining a negative pressure within the chamber 65. Thus, as the thermal tube 64 continues to cool, lowering the pressure within the chamber 61, a balancing lowering of the pressure within

the superheating means will hold the valve open as the pressure within the superheating means and supply lines continues to drop. Because of the lowered pressure, the saturation temperature of the liquefied gas will also drop, resulting in the passage of extremely cold gas into the output lines of the system. This supercold gas will chill delivery lines in the system to a temperature well below the saturation temperature of the gas at normal delivery pressures. In the event that the overcapacity demand is suddenly terminated, pressure within the system will instantly recover. When the gas within the supercooled delivery lines returns to normal pressure, the saturation temperature will suddenly rise above the supercooled temperature of the delivery system, resulting in condensation back to liquid of the gas standing in the lines. In turn, more gas will rush into the lines to replace the volume of the condensed gas until equilibrium is restored within the system. However, while the pressure in the system will equalize, the delivery lines will now be full of liquid gas.

Jurcik teaches that any liquid in the gas delivery system is undesirable, and discusses in detail several methods of preventing such liquid. Accordingly, it would be unreasonable to combine Jurcik with a device that may potentially result in a large amount of condensation within the delivery lines. Thus, Jurcik teaches away from a combination with Tanaka.

With respect to Moraski, a combination of Moraski with Tanaka would have similar results. However, inasmuch as Moraski is directed to the vaporization of flammable gases, it will be clear that a system capable of delivery liquid gas to burners that are configured to operate using vaporized gas would be extremely hazardous. Accordingly, Moraski as well teaches away from a combination with Tanaka. Accordingly, claim 1 is allowable as written, over all the cited prior art. Dependent claims 2-7 are also therefore allowable, together with independent claim 1.

Claim 8 recites, in part, "a pressure sensor configured to sense the differential pressure in the thermal expansion chamber and the liquefied gas inlet chamber," and further, "the valve being moved toward the closed and open configurations in response to the pressure sensor sensing the differential pressure in the thermal expansion chamber and the liquefied gas inlet chamber, with . . . the pressure in the liquefied gas inlet chamber being dependent on the pressure of the liquefied gas supplied by the source of liquefied gas." The Examiner will

recognize, without the need to reiterate the previous argument, that Tanaka fails to teach either of these limitations, nor do Moraski or Jurcik in combination with Tanaka teach or suggest these limitations. Accordingly, claim 8, together with dependent claims 9-15, is allowable over the cited art.

The amendments to claim 16 are not for the purpose of overcoming prior art, nor for patentability, but rather, are intended to broaden the scope of the claim. Amended claim 16 recites, in part, "a pressure sensor configured to sense a difference in the sensed temperature pressure and a pressure of the liquefied gas supplied by the source of liquefied gas," and further, "the valve being moved toward the closed and open configurations in response to variations in the difference in the sensed temperature pressure and the pressure of the liquefied gas." Again, the Examiner will recognize that Moraski, Jurcik, and Tanaka fail to teach these limitations, either individually or in combination. Accordingly, claim 16 is allowable, together with dependent claims 17-21.

Claim 35 recites, in part, "a plurality of vaporizers, each of the vaporizers including . . . a pressure sensor configured to sense the difference in the sensed temperature pressure and a pressure of a liquefied gas supplied by the source of liquefied gas, . . . and the valve being moved toward the closed and open configurations in response to the pressure sensor sensing the difference in the sensed temperature pressure and the pressure of the liquefied gas." Again, Tanaka's valve is not configured to sense a difference in the sensed temperature pressure and a pressure of the liquefied gas supplied by the source of liquefied gas, nor is the valve configured to respond to that difference. Accordingly, claim 35 is allowable over the cited prior art. Dependent claim 36-40 are also allowable, together with independent claim 35.

Claim 41 is a method claim directed to a method for vaporizing a liquefied gas, and includes the following limitations: "sensing a difference in the sensed temperature pressure and a pressure of a liquefied gas supplied by the source of liquefied gas; and adjusting the flow rate of the liquefied gas into the heat exchanger in response to the difference in the sensed temperature pressure and the pressure of the liquefied gas supplied by the source of liquefied gas." Jurcik fails to teach the cited steps of claim 41, nor does Jurcik suggest any advantages that might be gained through a combination with other art teaching those steps. Instead, Jurcik employs a different regulation system, as follows: "the pressure read by the pressure sensor

indicates the pressure at which vaporization is occurring, and further provides input to a controller which adjusts the heat transfer rate increasing means" (column 13, lines 1-4); "the setpoint for the superheating control temperature will depend, for example, on the current cylinder pressure and cylinder wall temperature" (column 13, lines 19-21); "the control system determines the energy requirements of the gas cylinder, and switches the power to the bottom heater on or off depending on those requirements" (column 13, lines 54-56). Thus, Jurcik depends on various heating systems for regulation of pressure and temperature.

Moraski fails to teach the cited steps of claim 41, but rather teaches a pressure vessel having an inlet valve controlled by a solenoid for admitting liquefied gas into the pressure vessel, and a float switch configured to deactivate the solenoid and close the valve in the event that demand exceeds capacity. Thus, not only does Moraski fail to teach the cited steps, but Moraski fails to teach or suggest any motivation for incorporating the cited steps in a vaporizing method.

As previously described, Tanaka also fails to teach the cited steps. In view of the foregoing, there is no combination of Jurcik, Moraski, or Tanaka that teaches all the limitations of claim 41. Accordingly, claim 41 and dependent claim 42 are both allowable over the cited prior art. The amendment to claim 41 is made for the purpose of clarity, and does not affect the scope thereof.

Claim 43 recites, in part, "pressure sensor arranged to sense the difference in the sensed temperature pressure and a pressure of the liquefied gas supplied by the source of liquefied gas; and a flow regulator valve arranged to regulate the flow of liquefied gas from the source of liquefied gas to the heat exchanger inlet in response to the pressure sensor sensing the difference in the sensed temperature pressure and the pressure of the liquefied gas." The Examiner has cited a combination of Moraski or Jurcik in view of Tanaka as teaching all the elements of claim 43, relying on Tanaka to show the elements of 43 cited herein. As previously argued, Tanaka fails to teach these elements, and thus, in combination with Moraski or Jurcik, cannot teach or suggest all the limitations of claim 43. Accordingly, claim 43 is allowable over the cited art. Dependent claims 44-53 are also therefore allowable. The amendment to claim 43 is not made for purposes of patentability, but rather to broaden the scope of the claim, and therefore does not limit the claim with respect to the doctrine of equivalence.

Claim 54 recites "a pressure sensor arranged to sense the difference in the sensed temperature pressure and a pressure of a liquefied gas supplied by the source of liquefied gas; and a flow regulator valve arranged to regulate the flow of liquefied gas from the source of liquefied gas to the heat exchanger inlet in response to the pressure sensor sensing the difference in the sensed temperature pressure and the pressure of the liquefied gas." To the extent that the cited limitations of claim 54 are the same as those limitations cited with reference to claim 43, the arguments put forth in support of allowability of claim 43 may also be applied to demonstrate the allowability of claim 54, together with dependent claims 55-58.

A combination of Moraski or Jurcik with Tanaka fails to teach "third means for sensing a difference in the sensed temperature pressure and a pressure of the liquefied gas supplied by the source of liquefied gas, and fourth means for regulating a flow of liquefied gas from the source of liquefied gas to the first means in response to the difference sensed by the third means" as recited by claim 64. Accordingly, claim 64, together with dependent claims 65-68 is allowable over the cited prior art. Amendments to claim 64 and 65 are for clarity, and do not affect the scope of the claims.

Inasmuch as independent claims 1, 8, 16, 35, 41, 43, 54, and 64 have been demonstrated as being allowable, all remaining rejections are moot. However, it is worth noting that the additional art cited by the Examiner in those rejections teaches systems that are analogous to the system taught by Tanaka. Namely, systems in which a pressure downstream from a valve is compared with a pressure from a temperature sensor to regulate the valve. See, for example, column 2, lines 57 and 58 of Nielsen, and column, lines 57-61 of Barbulesco.

New claim 71 recites "a flow regulator having a first input coupled to the output of the temperature sensor, a second input coupled to a source of liquefied gas and configured to receive a flow of liquefied gas at a second pressure, and an output configured to be coupled to an input of the heat exchanger, the regulator configured to compare the first pressure to the second pressure and to adjust a flow of liquefied gas from the second input to the output to a flow rate selected according to a pressure differential of the first and second pressures." Claim 71 is fully supported in the specification, and is allowable over the cited prior art.

The Commissioner is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited. In the event the Examiner finds minor informalities that can be resolved by telephone conference, the Examiner is urged to contact applicants' undersigned representative at (206) 622-4900 in order to expeditiously resolve prosecution of this application.

Respectfully submitted,

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